Amendments to the claims

This listing of claims will replace all prior versions, and listings, of claims in the application

Listing of claims:

1. (Currently Amended) A measurement system configured to determine a critical dimension and a layer characteristic parameters of a structure during production, the system comprising:

a stage configured to support the structure during measurements;

a measuring unit ~~coupled to the stage,~~ comprising:

an illumination system configured to direct incident light of substantially broad wavelengths band with a predetermined solid angle of light propagation, toward a surface of the structure during a measurements; and

a detection system ~~coupled to the illumination system and~~ configured to detect light propagating from the surface of the structure during measurements,

wherein the measuring unit is configured to generate one or more output signals in response to the detected light during measurements; and

a ~~processor~~ computer system coupled to the measuring unit and configured and operable for ~~to determine the parameters of the structure from said one or more output signals during measurements, wherein said parameters comprise a critical dimension of the structure and a layer characteristic of the structure~~

- receiving and analyzing said output signals to extract spectral information, and

- fitting said spectral information to reference data to determine said parameters of the patterned structure, wherein said reference data is indicative of a weighted diffraction efficiency at plurality of angles of incidence around an average direction of said predetermined solid angle of light propagation toward a surface of the structure during measurement.

2. (Original) The system of claim 1, wherein the stage is further configured to move laterally during measurements.

3. (Original) The system of claim 1, wherein the stage is further configured to move rotatably during measurements.

4. (Original) The system of claim 1, wherein the stage is further configured to move laterally and rotatably during measurements.

5. (Original) The system of claim 1, wherein the illumination system comprises a single light source.

6. (Original) The system of claim 1, wherein the illumination system comprises more than one light source.

7. (Original) The system of claim 1, wherein the detection system comprises a single light detector.

8. (Original) The system of claim 1, wherein the detection system comprises more than one light detector.

9. (Original) The system of claim 1, wherein the measuring unit comprises a scatterometer.

10. (Original) The system of claim 1, wherein the measuring unit comprises a spectroscopic scatterometer.

11. (Original) The system of claim 1, wherein the measuring unit comprises a reflectometer.

12. (Original) The system of claim 1, wherein the measuring unit comprises a spectroscopic reflectometer.

13. (Original) The system of claim 1, wherein the measuring unit comprises a bright field imaging channel.

14. (Original) The system of claim 1, wherein the measuring unit comprises a dark field imaging channel.

15. (Original) The system of claim 1, wherein the measuring unit comprises bright field and dark field imaging channels.

16. (Original) The system of claim 1, wherein the measuring unit utilizes an ellipsometer light propagation scheme.

17. (Original) The system of claim 1, wherein the measuring unit utilizes a spectroscopic ellipsometer light propagation scheme.

18. (Original) The system of claim 1, wherein the measuring unit utilizes a two-beam spectrophotometer scheme.

19. (Original) The system of claim 1, wherein the measuring unit defines a first measurement channel and a second measurement channel, and wherein the first and second measurement channels are selected from of the following channels: a scatterometer, a spectroscopic scatterometer, a reflectometer, a spectroscopic reflectometer, a bright field imaging , a dark field imaging, bright field and dark field imaging, an ellipsometer, a spectroscopic ellipsometer, a two-beam spectrophotometer, multi-incidence angle reflectometer, multi-incidence angle ellipsometer.

20. (Original) The system of claim 1, wherein the measuring unit defines a first measurement channel and a second measurement channel, and wherein optical elements of the first measurement channel comprise optical elements of the second measurement channel.

21. (Original) The system of claim 1, wherein the processor is configured to determine, from the one or more output signals during measurements, the structure

parameter selected from a surface profile of the structure, a surface relief of a layer on the structure, and a topography parameter of a feature of the structure.

22. (Original) The system of claim 21, wherein the system is coupled to a process tool selected from a tool of a lithography tools arrangement and an etching tool.

23. (Original) The system of claim 1, wherein the system is configured to determine at least the parameters of the structure substantially simultaneously during measurements.

24. (Original) The system of claim 1, wherein the illumination system is configured to direct the incident light to multiple measurement sites on the surface of the structure, and wherein the detection system is configured to detect light propagating from the multiple measurement sites on the surface of the structure such that one or more of the parameters of the structure can be determined at the multiple measurement sites.

25. (Original) The system of claim 1, wherein the system is coupled to a processing tool.

26. (Original) The system of claim 1, wherein the system is coupled to a processing tool, and wherein the system is at least partly disposed within the processing tool.

27. (Original) The system of claim 1, wherein the system is coupled to a processing tool, and wherein the system is integrated with a processing tool arrangement.

28. (Original) The system of claim 1, wherein the system is coupled to a processing tool, and wherein the processing tool comprises a robot means configured to move the structure to the stage for measurements.

29. (Original) The system of claim 1, wherein the system is coupled to a processing tool, and wherein the system is configured to determine the parameters of the structure while the structure is between processing steps.

30. (Original) The system of claim 1, wherein the support stage supports the structure during measurements in a horizontal plane.

31. (Original) The system of claim 1, wherein the system is coupled to a processing tool, and wherein the processing tool is selected from the group including a tool of a lithography tools arrangement and an etching tool.

32. (Original) The system of claim 1, wherein the stage and the measuring unit are configured as an integrated system being disposed within a processing tool.

33. (Original) The system of claim 1, wherein the support stage and the measuring unit are configured as an integrated system being coupled to a processing tool.

34. (Original) The system of claim 1, wherein the support stage and the measuring unit are disposed with respect to a processing tool such that a robot of the processing tool is capable of supplying the structure between the processing tool and the measuring unit.

35. (Original) The system of claim 1, wherein the processor is coupled to a processing tool and is configured to adjust a parameter of the processing tool in response to the determined parameters of the structure.

36. (Original) The system of claim 1, wherein the processor is configured to carry out statistical analysis of the determined parameters of the structure and parameters of a plurality of structures during measurements.

37. (Original) The system of claim 36, wherein the statistical analysis includes at least one of the following: in-wafer statistics, wafer-to-wafer statistics, lot-to-lot statistics, module-to-module statistics.

38. (Original) The system of claim 1, wherein the processor is configured to compare the determined parameter of the structure to a predetermined range for this parameter.

39. (Original) The system of claim 1, wherein the processor is configured to adjust a parameter of a processing tool coupled to the measuring unit in response to the determined parameters of the structure using a feedback control technique.

40. (Original) The system of claim 1, wherein the processor is configured to adjust a parameter of a processing tool coupled to the measuring unit in response to the determined parameters of the structure using a feedforward control technique.

41. (Original) The system of claim 1, wherein the processor is configured to create a database, wherein the database comprises the determined parameters of the structure.

42. (Original) The system of claim 41, wherein the processor is configured to calibrate the measuring unit using the database.

43. (Original) The system of claim 42, wherein the processor is configured to monitor output signals generated by the measuring unit using the database.

44. (Original) The system of claim 42, wherein the database comprises the parameters of a plurality of structures.

45. (Original) The system of claim 44, wherein the parameters of the plurality of structures are determined using the measuring unit.

46. (Original) The system of claim 44, wherein the parameters of the plurality of structures are determined using a plurality of measuring units.

47. (Original) The system of claim 46, wherein the processor is coupled to the plurality of measuring units.

48. (Original) The system of claim 47, wherein the processor is configured to calibrate the plurality of measuring units using the database.

49. (Original) The system of claim 47, wherein the processor is configured to monitor output signals generated by the plurality of measuring units using the database.

50. (Original) The system of claim 1, wherein the system is configured to determine the parameters of the structure at more than one site on the structure, wherein the structure comprises a wafer, and wherein the processor is configured to adjust at least one parameter of a wafer processing tool in response to at least one of the determined parameters of the structure at the more than one site on the structure to reduce within wafer variation of at least one of the determined parameters.

51. (Original) The system of claim 1, wherein the processor is coupled to a structure processing tool.

52. (Original) The system of claim 51, wherein the processor is configured to adjust a parameter of the processing tool in response to the determined parameters using a feedback control technique.

53. (Original) The system of claim 51, wherein the processor is configured to adjust a parameter of the processing tool in response to the determined parameters using a feedforward control technique.

54. (Original) The system of claim 51, wherein the processor is configured to monitor a parameter of the processing tool.

55. (Original) The system of claim 54, wherein the processor is configured to determine a relationship between the determined parameters and the monitored parameter of the processing tool.

56. (Original) The system of claim 55, wherein the processor is configured to adjust a parameter of the processing tool in response to the relationship.

57. (Original) The system of claim 1, wherein the processor is coupled to a plurality of measuring units, and wherein each of the plurality of measuring units is coupled to a processing tool.

58. (Original) The system of claim 1, wherein the processor comprises a local processor coupled to the measuring unit and a remote controller coupled to the local processor, wherein the local processor is configured to at least partially process the one or more output signals during measurements, and wherein the remote controller is configured to further process said partially processed output signals.

59. (Original) The system of claim 58, wherein the local processor is configured to determine the parameters of the structure.

60. (Original) The system of claim 58, wherein the remote controller is configured to determine the parameters of the structure.

61. (Original) The system of claim 1, wherein the measuring unit comprises a calibration channel configured for measuring a fraction of the illuminating light to determine its characteristic, simultaneously with said measurements.

62. (Original) The system of claim 61, wherein said calibration channel is configured to measure spectral characteristics of the illuminating light.

63. The system of claim 62, wherein said calibration channel comprises a spectrometer.

64. (Original) The system of claim 61, wherein said calibration channel is configured to measure intensity variations of the illuminating light.

65. (Original) The system of claim 64, wherein said calibration channel comprises a photodiode.

66. (Original) The system of claim 1, comprising more than one measuring unit, the measuring units for applying measurements to structures associated with

different processing tools, the measuring units being coupled to a common control system via a communication network.

67. (Original) The system of claim 66, wherein said different processing tools are operable to perform the same manufacturing step.

68. (Original) The system of claim 66, wherein said different processing tools are operable to perform different manufacturing steps.

69. (Original) The system of claim 66, wherein said different processing tools are associated with same FAB.

70. (Original) The system of claim 66, wherein said different processing tools are associated with different FABs.

71. (Original) The system of claim 66, wherein said processor is a part of said common control system.

72. (Original) The system of claim 66, comprising more than one processor, each of the measuring units being coupled to a corresponding one of the processors, the processors being connected to the common control system via the communication network.

73. (Original) The system of claim 66, wherein the common control system is accommodated outside a production line.

74. (Original) The system of claim 66, wherein said common computer system is connectable to a host machine of a FAB via said communication network.

75. (Original) The system of claim 74, wherein said connection between the computer system and the host machine enables closed loop control of a corresponding processing tool.

76. (Original) The system of claim 66, wherein the common control system is responsible for information from a user to prepare certain database to be available by a corresponding measuring unit via the communication network.

77. (Original) The system of claim 1, wherein the layer characteristic includes a layer thickness.

78. (Original) The system of claim 1, comprising at least one sensor configured for sensing at least one internal parameter of the measuring unit, thereby enabling monitoring of the operation of the measuring unit.

79. (Original) The system of claim 78, wherein the sensed parameter includes at least one of temperature and light source condition.

80. (Original) The system of claim 78, wherein the sensor is configured to generate an alarm signal in case of malfunction or evidence for required preventive maintenance.

81. (Original) The system of claim 20, wherein the optical elements include at least one polarizer.

82. (Original) The system of claim 81, wherein the polarizer is accommodated in optical paths of the incident light propagating towards the structure and the light propagating from the structure towards the detection system.

83. (Original) The system of claim 81, wherein the polarizer is mounted for rotation so as to change its preferred polarization.

84. (Original) The system of claim 81, wherein the polarizer is mounted so as to be shifted between its two operational positions to be in or out of an optical path of light propagating through the measuring unit.

85. (Original) The system of claim 1, comprising an optical character recognition (OCR) channel.

86. (Original) The system of claim 85, wherein the OCR channel includes an optical detector and a controller running OCR software.

87. (Original) The system of claim 85, wherein the OCR channel includes at least one of optical elements of the measuring unit.

88. (Original) The system of claim 85, wherein the optical detector of the OCR channel is connectable to the processor.

89. (Original) The system of claim 85, wherein the optical detector of the OCR channel is connectable to a central controller.

90. (Currently Amended) A method for determining a critical dimension and a layer characteristic parameters of a structure, the method comprising:

disposing the structure upon a stage, ~~wherein the stage is coupled to a measuring unit, and wherein the measuring unit comprises an illumination system and a detection system~~;

subjecting the structure on the stage to measurements by a measuring unit comprising an illumination system and a detection system, the measurements comprising operating the illumination system for directing light toward a surface of the structure with a predetermined solid angle of light propagation~~using the illumination system;~~, detecting by said detection system light propagating from the surface of the structure ~~using the detection system;~~ , and generating one or more output signals in response to the detected light; and

processing data indicative of the one or more output signals, said processing comprising extracting spectral information from said data, and fitting said spectral information to certain reference data to determine said parameters of the patterned structure, the reference data being indicative of weighted diffraction efficiency at plurality of angles of incidence around an average direction of said predetermined solid angle of light propagation toward a surface of the structure during measurement

~~to determine parameters of the structure, wherein said parameters include a critical dimension of the structure and a layer characteristic of the structure~~.

91. (Currently Amended) A computer-implemented method for controlling a system comprising a measuring unit and being configured to determine a critical dimension and a layer characteristic parameters of a structure, ~~wherein the system comprises a measuring unit,~~ the method comprising:

controlling operation of the measuring unit, wherein the measuring unit comprises an illumination system and a detection system~~, and wherein the measuring unit is coupled to a stage~~, said controlling comprising:

controlling the illumination system to direct light toward a surface of the structure with a predetermined solid angle of light propagation;

controlling the detection system to detect light propagating from the surface of the structure~~;~~ and ~~generating~~ generate data indicative of one or more output signals responsive to the detected light; and

processing said data indicative of the one or more output signals, said processing comprising extracting spectral information from said data, and fitting said spectral information to certain reference data to determine said parameters of the patterned structure, the reference data being indicative of weighted diffraction efficiency at plurality of angles of incidence around an average direction of said predetermined solid angle of light propagation toward a surface of the structure during measurement ~~to determine parameters of the structure, wherein the parameters comprise a critical dimension of the structure and a layer characteristic of the structure~~.

92. (Currently Amended) A method for fabricating a semiconductor device, the method comprising:

forming a portion of the semiconductor device upon a structure;

disposing the structure upon a stage~~, wherein the stage is coupled to a measuring unit~~, and subjecting the structure to measurements ~~wherein the~~by a measuring unit ~~comprises~~ comprising an illumination system and a detection system~~;~~, the

measurements comprising operating the illumination system for directing light toward a surface of the structure with a predetermined solid angle of light propagation~~using the illumination system;~~, detecting by said detection system light propagating from the surface of the structure~~ using the detection system;~~ and generating data indicative of one or more output signals in response to the detected light; and

processing said data indicative of the one or more output signals to determine said parameters of the structure, said processing comprising extracting spectral information from said data, and fitting said spectral information to certain reference data to determine ~~wherein the parameters comprise~~ a critical dimension ~~of the structure~~ and a layer characteristic parameter of the structure, the reference data being indicative of weighted diffraction efficiency at plurality of angles of incidence around an average direction of said predetermined solid angle of light propagation toward a surface of the structure during measurement.

93. (Original) The method of claim 92, comprising identifying the structure under measurements by the structure identity number.

94. (Original) The method of claim 93, wherein said identifying comprises applying to the structure an optical character recognition (OCR).

95. (Currently Amended) A system configured to determine a critical dimension and a layer characteristic parameters of a structure, the system comprising:

a stage configured to support the structure;

a measuring unit ~~coupled to the stage, and~~ comprising: an illumination system configured to direct light toward a surface of the structure during measurements with a predetermined solid angle of light propagation; and a detection system coupled to the illumination system and configured to detect light propagating from the surface of the structure during measurements, wherein the measuring unit is configured to generate one or more output signals responsive to the detected light;

a computer system comprising a local processor coupled to the measuring unit and configured to at least partially process the one or more output signals~~;~~, and a remote controller coupled to the local processor, wherein the remote controller is configured to receive the at least partially processed one or more output signals and ~~to~~ determine said parameters of the structure from the at least partially processed one or more output signals, ~~wherein the parameters comprise a critical dimension of the structure and a layer characteristic of the structure~~ the local and remote processors operating together to carry out the following: extracting spectral information from said data, and fitting said spectral information to certain reference data to determine said parameters of the patterned structure, the reference data being indicative of weighted diffraction efficiency at plurality of angles of incidence around an average direction of said predetermined solid angle of light propagation toward a surface of the structure during measurement.

96. (Currently Amended) A method for determining a critical dimension and a layer characteristic parameters of a structure, the method comprising:

disposing the structure upon a stage, and subjecting the structure to measurements by ~~wherein the stage is coupled to~~ a measuring device~~, and wherein the measuring device~~ comprises an illumination system and a detection system~~:~~, the measurements comprising operating the illumination system for directing light toward a surface of the structure ~~using the illumination system~~ with a predetermined solid angle of light propagation~~;~~, detecting by said detection system light propagating from the surface of the structure ~~using the detection system:~~, and generating one or more output signals responsive to the detected light; and

processing the one or more output signals to determine said parameters of the structure, ~~wherein the parameters comprise a critical dimension of the structure and a layer characteristic of the structure,~~ said processing comprising extracting spectral information from said data, and fitting said spectral information to certain reference data to determine said parameters of the patterned structure, the reference data being indicative of weighted diffraction efficiency at plurality of angles of incidence around

an average direction of said predetermined solid angle of light propagation toward a surface of the structure during measurement, said processing being carried out by:

at least partially processing the one or more output signals using a local processor~~, wherein the local processor is~~ coupled to the measuring unit;

sending data resulting from the partial~~ly processed~~ processing ~~one or more output signals~~ from the local processor to a remote controller; and

further processing said data resulting from the partial~~ly processed~~ processing ~~one or more output signals using~~at the remote controller.